OPERATING INSTRUCTIONS
Extension of the machine

INDEX

Bar loading magazines and bar guiding system

INDEX Multi spindle turning machines

Control system INDEX C200-sl

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Note on applicability

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A word on copyright

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Preface

The present document gives a description of the tasks of the loading magazines and of the pre-conditions a machine must have for the operation of a loading magazine. This document is meant for the programming personnel, the personnel who set up the machine and for the persons who operate the machine.

For the purposes of the above mentioned persons, the present document will also put an emphasis on the characteristics of the loading magazines which can be operated at the machine.

Operating modes can be preset by both, loading magazine and machine. However, said modes can only be implemented, if loading magazine and machine preset identical operating modes. The loading magazine has no influence on the processes of the machine.

Requirements concerning the properties of the material bars

The material bars used must meet high requirements as to straightness, surface quality and diameter tolerances.

Especially the straightness of the bars is of great importance. It essentially influences the running smoothness, the maximum speeds and thus the turning quality as a whole

The exact requirements as well as the suggested test methods have been described in the "Material bar requirements" document.

In addition, you must heed the information in the respective documents of the bar loading magazine manufacturers.

Things in common

Cooling lubricant

The amount of the cooling lubricant which is passed in the respective tubes is of great importance in position 6 when the bar remnant is removed and discharged by means of the loading magazine during the loading cycle. Please heed, that as little as possible cooling lubricant gets into the work spindle! For this reason, the lubricating system is normally switched off in the bar loading programme.

Guidance liner tubes (FZ- tubes)

The use of simultaneously revolving guidance liner tubes reduces the in-spindle room (in harmony with the bar diameter). By this, the quality of the bar guidance is improved in the area of the work spindle, especially, if the bar slider runs in into the work spindle.

The more play between bar and guidance liner tube, the greater the danger of vibrations.

Material feed

The following aspects and attachments are of importance for the material feed:

- work spindle speed during material feed

  The braking and acceleration of the material bar before and after feeding may have negative effects on the quiet running of the bar.

  If the work spindle is not braked, the speed of the material bar will drop with reference to the work spindle speed. With chucking, the bar is accelerated again, whereat the closing collet slips over the material which will impair the surface of the bar and will cause abrasion.
- feed rate of the loading magazine
- feed force of the loading magazine

  Feed rate and feed force must be harmonised with the workpiece which is to be fed and with the material bar which has to be moved.
- The picking-up of the bar prevents that the arriving bar bounces the stop too hard.
- workpiece pull-up attachment
- pulling-up by means of synchronised collet

The feed has to be harmonised with the conditions and the attachments.

Machine operating panel

At the operating panel of the machine you can appoint cycles (in the "Control cycle" screen) which are aiming at the conditions of the loading magazines or of the machine.

The screens may be protected by access authorisation and can thus be assigned to the appropriate group of persons.

"Cycle control" screen.

The "Cycle control" screen is especially meant for the machine operators.

In the "Cycle control" screen the following functions of the loading magazine are being controlled via softkeys depending on the bar loading magazine existing at the machine.

- feed bar (pull-feed)
- loading (release loading)
- machining of 1 workpiece
- spot-drilling
- emptying of magazine
- cycle stop after machining

For descriptions of the functions in screen "Cycle control" in case of machines with control system C200-sl refer to document "Operating the machine", please.

"Material chucking" screen (bar loading)

The "Material chucking" screen in the "Operate units" area is especially meant for the "Set-up" personnel.

Navigation

Navigation in case of control system C200-sl: (machine operating area) → Initiation of operation → Magazine

The screen "Magazine" will appear. In said screen, you can initiate the automatic loading of material bars.

In the "Magazine" screen the following functions of the loading magazine are being controlled via softkeys depending on the bar loading magazine existing at the machine.

- loading
- clamping / releasing of material
- pushing the bar
- measuring the bar
- manual spot-drilling
- manual loading

For descriptions of the functions in screen "Operate units" → Magazine of control system C200-sl refer to document "Operating the machine", please.

For this, the following pre-conditions must be fulfilled:

- The loading magazine is in "Automatic" mode. The protection hoods of the machine are closed.
- No material in spindle in position 6
  (if necessary, remove material and discharge it via screen "Cycle control")
- Material chuck in position 6 is open.
- The cursor in screen "Material chucking" points at position 6
- Material present for loading

The loading cycle is started via the "Start loading" softkey.

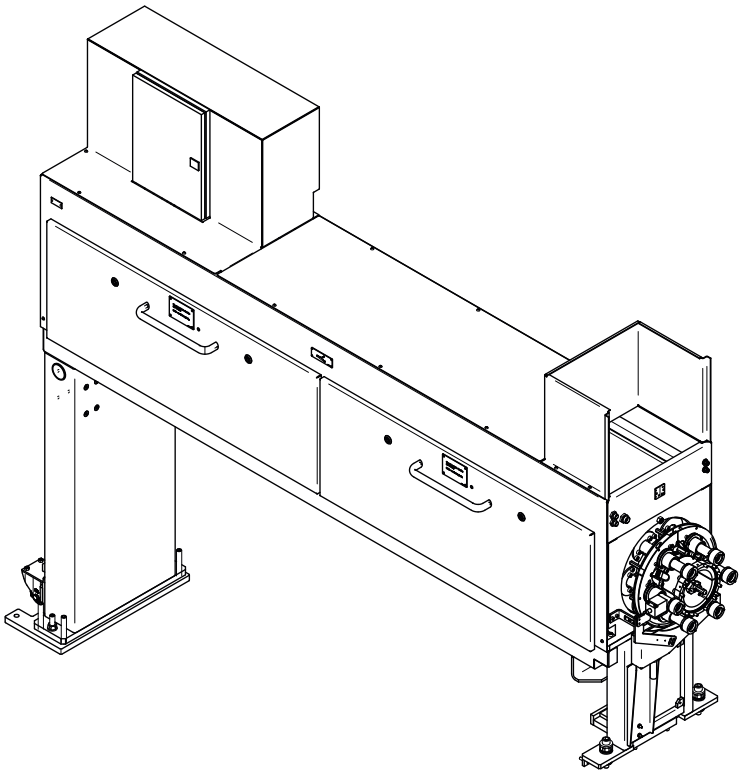
Thereafter, one new material bar will be loaded.

After the end of the loading procedure message "765208 LOADING MAGAZINE material loaded" will appear.

In this operating mode, you can preset the checking and feed-in positions.

Bar loading magazines in detail

INDEX bar guiding system



The INDEX-bar guiding system is a mere bar guiding system, i. e. bars must be re-loaded manually. For production, the bars must be pulled forward into the machining area. After production, the bar remnants will be pushed forward for discharge via the machining area.

The bar management respectively the administration of the technical data (like e. g. bar length, workpiece length) is carried out within the machine.

Safety information

The bar guiding system is located immediately at the end of the work spindles. The magazine is positively tied with the machine. The transition area between bar guiding system and machine is a very dangerous spot. Said area is covered by protection hoods. Assembly in this area may only be carried out with main switch being OFF.

The end of the magazine in position 6 is safeguarded by the "loading **safety** attachment".

Spindle carrier indexing and work spindle speeds are only possible, if the loading **safety** attachment is closed.

Assignments and machine data

Selection via MAZU 96

Navigation

Navigation in case of control system C200-sl

Parameters → User settings→ Material flow → Bar guiding system.

For descriptions of the functions in screen "User settings" of control system C200-sl, refer to document "Operating the machine", please.

Assignments at the bar guiding system

none

"Manual" mode

No manual operation

Instructions in the part programme

For the pull-up attachment and the loading safety attachment

M187	1st feed (here, the material remnant length is calculated)
M7=81	open loading **safety** attachment
M7=82	close loading **safety** attachment

Marginal conditions

Input of material length:

a) In case of operated material end switch:

The newly loaded bar is of such length that the material end switch is operated. In the "Cycle control" screen you enter the bar length in mm, by pressing the "Input" key, said value will be taken over and "Material present" will be set.

You can only enter values which are greater than the value in MD14510 "Distance material end switch".

b) In case material end switch is not operated:

The newly loaded bar is not of such length that the material end switch is operated. In the "Control cycle" screen the bar length is entered in mm, by pressing the "Input key" said value will be taken over and "Material present" will be set.
You can only enter values which are smaller than the value in MD14510 "Distance material end switch", however, such values must at least be great enough that the production of a part is still possible.

Calculation of the material length:

The time of calculation is with M-function M187, as soon as calculation is released. Usually, the above M-function is programmed in the position where material pull-up takes place, too.

The material end switch is checked after every spindle carrier indexing (in position 6).

Reaction at material end:

If "Material end" is recognised with production being switched ON, there is automatic branching to "Cycle end". In the cycle end programme part, you then can immediately open the loading safety attachment. The decision on whether a part can still be produced or whether "material end" is issued, depends on the parameters which have been entered in screen 1016 (workpiece length, position of the chuck, cut-off position, distance material end switch).

INDEX MBL

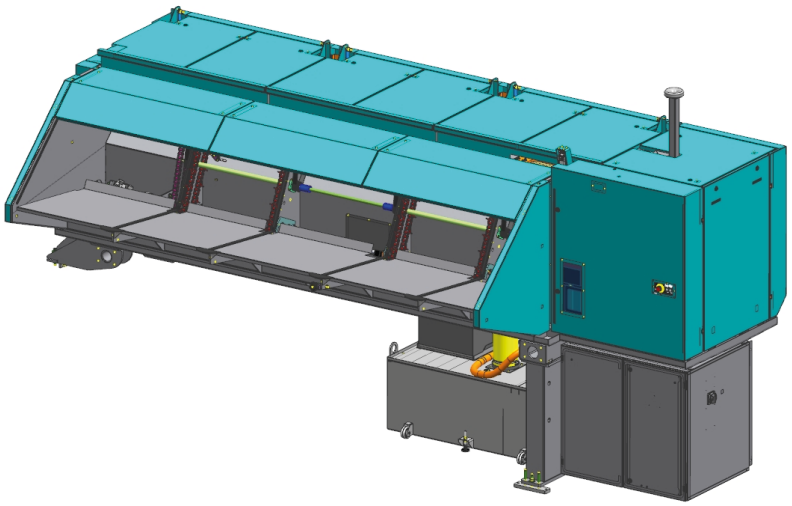
The bar loading magazine serves the supply, spot-drilling, guidance and feed of material bars as well as the disposal of remnants thereof at a multi-spindle turning machine.

By means of the bar loading magazine, you can process round and hexagonal material. The loading magazine possesses an individual control system and is being connected with the machine by means of a defined interface (UNIMAG).

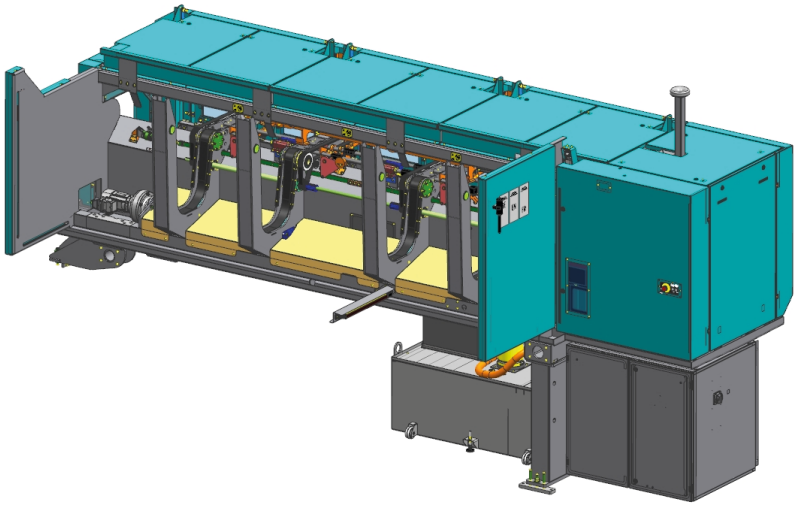
Merely the function of the magazine's hydraulic system and sealing air supply are being guaranteed by the machine.

The bar loading magazine is available in different supply variants, that is to say as a bundle or as a rack loading magazine as well as a magazine for bar lengths of 3300 mm respectively 4300 mm. In addition, a 50 Hz and a 60 Hz magazine version is available.

Extra operating instructions are available for the INDEX MBL loading magazine.



Rack loading magazine



Bundle loading magazine

IEMCA SIR

The IEMCA - SIR - "loading magazine" performs the following tasks: bar loading, bar guiding, workpiece feed and remnant disposal.

The "material end" message is managed in the machine and the respective reactions will be generated.

Bar change: After "last feed of good workpiece" (will be machined until position 6), the bar change is carried out in position 6 whereat the bar is pushed forward to a stop.

Safety information

EMERGENCY-OFF of the machine has effect on the EMERGENCY OFF of the loading magazine and vice versa EMERGENCY-OFF of the loading magazine has effect on the EMERGENCY OFF of the machine.

Material slider motions at the loading magazine are only possible if the protection hoods of the machine are closed.

Bar drilling station with IEMCA SIR

For a better guidance quality, the material bars are spot drilled, in order to be able to grip them by means of an internal chuck.

Held by an expanding mandrel, material bars can be guided closer in the area of the work spindle, thus enhancing the pre-conditions for an excellent turning quality. Before loading the bar into the guiding channel of the loading magazine, the clamped material bar will be spot drilled at the point where the clamping sleeve normally embraces the bar by means of a moving drilling spindle with minimal amount lubrication, The atomised lubricant guarantees optimum durability of the drill.

Please refer to the description of the loading magazine manufacturer.

Special procedures

The following special procedure is possible:

- Remnant removal in the machining area of the machine; selection happens via MAZU 97 Bit4=1 IEMCA feeder with inner cone.
  This possibly might enhance the material bar guidance quality (no clamping sleeve required).

See description of loading magazine manufacturer, please.

Assignments and machine data

Selection via MAZU 97

Assignments at the loading magazine

See documentation of the loading magazine manufacturer

Functions in "Cycle control"

See common things in "Cycle control"

Instructions in the part programme

For the pull-up attachment and the loading safety attachment

M187 1st feed (the material remnant length is calculated during this)

M287 2nd feed (the 2nd feed must not be made via M187)

M387 3rd feed

M487 Pushing OFF (included in M68)

For the bar change

M587 Start loading cycle

M1687 Wait for loading release (if positions 1 through 5 are complete)

M1787 Stop main spindles of positions 1..5

M1887 Release main spindles of positions 1..5

Bar end / bar start programme (e. g. MA62_MPF)

Call of the sub-programme "MA62_MPF":
/1 N210 MA62_MPF;
The block skip level "/1" is intended for the loading of new material bars.
Block N210 is carried out under the following conditions:

- no workpiece present
- or workpiece machined in position 1 A- side
- production has been selected (in "Cycle control")
- and no material bar present
- and loading release (in "Cycle control")

Abortion of a bar change

In case bar change is aborted (e. g. because a profiled bar does not find the entry of the profiled collet), the following steps can be carried out:

- press "RESET" and "Error delete" key
- keep protection hoods of the machine closed
- magazine "Manual" operating mode
- magazine slider return motion and remove material bar
- check bar start - make even, if deformed
- magazine "Automatic" operating mode
- machine screen "Material chucking" feed new bar → loading start

*) In case of eight-spindle turning machines: positions 1 through 7

Multiple feed motion / Double-three- and double-four-spindle machines

Double-three-spindle-machines

In the "Double-three-spindle-machine" machining version, 120 degree spindle carrier indexings are carried out.

The feed motion in position 6 is carried out in the sequence spindle 6 - 2 - 4.

The feed motion in position 3 is carried out in the sequence spindle 3 - 5 - 1.

A bar change can only be carried out in position 6. Consequently, for the "Loading" of spindles working in the sequence 3 - 5 - 1, a 60 degree spindle carrier indexing must integrated in the cycle.

Double-four-spindle machines

MS22-8 machines can be operated as double-four-spindle machines. At this, 90 degree spindle carrier indexings are being carried out.

Bar change can only be carried out in position 8. As a result of this, for "loading" a 45 degree spindle carrier indexing must be carried out for those spindles which are working in positions with uneven numbers.

For descriptions of how this is being carried out and programmed, refer to document "Rear-end machining with two synchronised swivelling units", section "Double-four-spindle machines", please.

Operating modes

The following settings of the operating modes must be made at the loading magazine and at the machine:

	Machine		**Loading magazine**
Approach reference point	Automatic	→	Automatic
Approach starting point	Automatic	→	Automatic
Run programme	Automatic	→	Automatic
Operate units	JOG	→	JOG
Set-up position/tool carrier	Automatic	→	Automatic
Memory overwriting	Automatic	→	Automatic
Selector switch in "Set-up" position	irrelevant		
Automatic start		→	Automatic

IEMCA Next 25 - INDEX MS16-6

The IEMCA Next 25 – MS16-6-"loading magazine" performs the following tasks: bar loading, bar guidance and initial material feed. Material feed and remnant removal must happen via the machining area (feed collet respectively pull-feed collet; material insertion attachment).

Bar management (bar length, material length) is implemented within the machine.

Bar change: After "Last feed for good workpiece" (is being processed up to position 6), bar change happens in position 6. At this, the remnant is being ejected into the machining area and must be discharged from there.
Material feed is carried out by the machine.

The loading cycle can be abbreviated via the standard functions "ahead-of-schedule loading" and " ahead-of-schedule sliding".

Attention

In case the internal material feed device is used with machine MS16-6, the bar end must be plane and have a minimum chamfer of 2x45°!

IEMCA Next 25 - INDEX MS16-6

Assignments and user setting

Selection via Mazu 101

Activation of user setting A5 (see document "Operating the machine")

Assignments at the loading magazine

See documents of the manufacturer of the loading magazine

Commands in the part programme

Pulling up

M187 - 1st pulling up (here, material remnant length is calculated)

M287 - 2nd pulling up

Loading

M887 - Pre-positioning of a new material bar

M587 - Loading cycle: insertion of new material bar into the spindle

M1687 - waiting for loading release (in case positions 1 through 5 are complete

M1787 - stop main spindles of positions 1 through 5

M1887 - release main spindles of positions 1 through 5

Pre-mature loading (Pre-Load)

In case the machine control system recognises that only 1 to 2 part/s can still be produced from the currently machined bar due to the material remnant length, pre-mautre loading of a new bar from the magazine is requested in case pulling up and loading have been released. Thereafter and simultaneous to part production, a new bar is loaded into channel 6 by the magazine.

If the above procedure lasts longer than one cycle pass, drum indexing will be delayed.

Loading cycle

The process of loading of a new material bar is sub-devided into 3 phases.

1. Automatically running pre-load, see above.
2. Pre-positioning of the new bar parallel to finish-machining of the last part in position 6. Pre-positioning is programmed in position 6 at the beginning of the part programme.

   /1 N410 M887
3. Insertion of the new bar into the spindle. This is programmed in position 6 at the end of the part programme together with the call of the loading sub-programme, for instance in the following way:

   /1 N820 MA62

   This sub-programme contains spindle stop, open material chuck, loading command M587 and face turning.

Block skip level /1 means that this block is only called up if loading is supposed to happen in case of

– no material present

  or

– machining of last workpiece in position 5 completed
– pulling up has been selected (in the "Control process" operating area)
– no material bar present
– loading has been released (in the "Control process" operating area)

In case of multi-sided material which is larger than width across flats 11, command M887 must be integrated into the loading sub-programme. In such case no machining with running spindle must happen during

pre-positioning.

Operation modes

Required settings of the operation modes at the loading magazine and at the machine:

	Machine		**L**oading magazine
Approaching of reference point	Automatic	→	Automatic
Approaching of starting point	Automatic	→	Automatic
Run programme	Automatic	→	Automatic
Operate units at the machine	JOG	→	Automatic
Operate units at the loading magazine	Automatic	→	Manual
Set-up position/tool carrier	Automatic	→	Automatic
Memory overwriting	Automatic	→	Automatic

IEMCA PRA magazine

The IEMCA - PRA magazine is no bar guiding and no workpiece feeding attachment but a "bar loading magazine" or a "breech loader" which loads a new material bar into the bar guiding system of the machine, pushes the remnant of the preceding bar into the machining area of the machine, positions the new bar and then moves back into its home position. In home position, a new bar will be placed ready into the bar guiding channel. The slide-in control system consists of a mechanical wheelwork and will be started by an approach switch. With backward travel of the slider, the wheelwork will be re-set.

The approach switch of the slide-in control system serves as reference point for the measurement of the bar length.

The length of the fed bars must be within a certain tolerance.

The bar management respectively the administration of the technical data (like e. g. bar length, workpiece length, number of workpieces) is implemented within the machine.

Safety information

The IEMCA - PRA loading magazine is located immediately behind a bar guidance system and is positively tied with said bar guidance system. The transition area between bar guidance system and loading magazine is a highly dangerous spot. This area is covered by protection hoods. Assembly in said area may only take place with main switch being OFF.

The guidance tubes at the end of the bar guidance system are safeguarded by the "loading safety attachment".

Spindle carrier indexing and work spindle speeds are only possible if the loading safety attachment of the bar guidance system is closed.

The IEMCA-PRA itself has no influence on the spindle carrier indexing release.

EMERGENCY-OFF of the machine has effect on the loading magazine and EMERGENCY-OFF of the loading magazine has effect on the machine.

Assignments and machine data

Selection via MAZU 98

Times: maximum loading time = 100 secs.

Assignments at the loading magazine:

The following must be set at the loading magazine:

- insertion position (position of the bar in the machining area after the feeding of a new bar)
- switching moment input - creep speed with insertion
- the point of the insertion path at which the remnant length will be checked.

Checking of the bar length (minimum length, maximum length) will be carried out in the loading magazine via setting of the switch.

In the switch cabinet of the loading magazine, you have to set the selector switch S51 to "OFF" (no jogging of work spindle)

"Manual" mode

Workpiece slider forward/backward

at the operating panel of the IEMCA-loading magazine

Automatic material bar loading:

In the "Material chucking" screen you can manually activate automatic material bar loading.

See "Common things" in "Material chucking"

Instructions in the part programme

For the pull-up attachment and the loading safety attachment

M187 1st feed (the material remnant length is calculated during this)

M287 2nd feed (the 2nd feed must not be made via M187)

M487 Pushing OFF (included in M68)

M7=81 Open loading safety attachment

M7=82 Close loading safety attachment

For the bar change

M587 Start loading cycle

M1687 Wait for loading release (if positions 1 through 5 are complete)

M1787 Stop main spindles of positions 1..5

M1887 Release main spindles of positions 1..5

Bar end / bar start programme (e. g. MA62_MPF)

Automatic loading in the "Automatic" mode

Call of the sub-programme "MA62_MPF":

/1 N210 MA62_MPF;

The block skip level "/1" is intended for the loading of new material bars.

Block N210 is carried out under the following conditions:

- no workpiece present
- or workpiece machined in position 1 A- side
- production has been selected (in "Cycle control")
- and no material bar present
- and loading release (in "Cycle control")

Abortion of a bar change

In case bar change is aborted (e. g. because a profiled bar does not find the entry of the profiled collet), the following steps can be carried out:

- In "Manual" mode: move slider backward into home position. Therewith, you have to heed, that no new bar gets into the guidance channel. Or, if bar is manually inserted, let new bar slide into the guidance channel.
- Remove remnant from collet
- Move pick-up attachment into rear position in "Operate units"
- Remove material bar out of bar guidance system (check bar start - make even) or insert manually into the collet and assign material.
- Press "RESET" and "Error delete" key
- Re-feed bar via screen "Material chucking" → Loading start

Pre-condition: loading magazine pusher in rear position, new bar in guidance channel and material chuck open.

Multiple feed motion / double-three-spindle-machines

Double-three-spindle-machines

In the "Double-three-spindle-machine" machining version, 120 degree spindle carrier indexings are carried out.

The feed motion in position 6 is carried out in the sequence spindle 6 - 2 - 4.

The feed motion in position 3 is carried out in the sequence spindle 3 - 5 - 1.

A bar change can only be carried out in position 6. Consequently, for the "Loading" of spindles working in the sequence 3 - 5 - 1, a 60 degree spindle carrier indexing must integrated in the cycle.

Marginal conditions

The power supply of the magazine can be disconnected from the mains via the main switch of the machine.

Actions for the feeding of profiled material (work spindle speeds, rocking) must be implemented via instructions in the part programme. The signals provided for this by the magazine (feed motion, start of the spindle) are irrelevant and are partly used for other functions. Material end in the magazine (last bar inserted) will not be displayed separately at the machine but will result in a general trouble of the "Ready" condition.

Remnants must be removed manually.

Calculation of the material length

The calculation of the material length will only happen after calculation has been released.

During this, the entered values will be maintained.

The moment of calculation is during M-function M187, after calculation has been released.

The material end switch (in position 6) will be checked after every spindle carrier indexing.

As soon as the material bar has left the material end switch, calculation of the remnant length will be released for the material which is in position 6.

Operating modes

The following settings of the operating modes are required to be made at the loading magazine and at the machine:

	Machine		**Loading magazine**
Approach reference point	Automatic	→	irrelevant
Approach starting point	Automatic	→	irrelevant
Run programme	Automatic	→	Automatic
Operate units	JOG	→	irrelevant
Set-up position/tool carrier	Automatic	→	irrelevant
Memory overwriting	Automatic	→	irrelevant
Selector switch to "Set-up"	irrelevant		
Automatic start		→	Automatic
Protection hoods are locked		←	Selector switch to "Set-up"
Irrelevant		←	Selector switch to position "0"

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